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EFFECT OF SOLUTIONS OF FILTER ALUM ON BRASS PIPE AND FITTINGS[1]

By G. R. Spalding

In 1906 the Hackensack Water Company installed a line of 2-inch standard seamless brass pipe to convey alum solution from the application tank to the dosing point, 170 feet distant. The line was made up with standard heavy pattern brass fittings and had a 2-inch connection through which water at 80 pounds pressure could be supplied for flushing purposes. The average rate of flow through this pipe was 7½ gallons per minute, corresponding to 43 linear feet per minute. Considerable trouble from plugging was experienced and as time went on it became necessary to flush the pipe more and more frequently. Leaks developed at the joints occasionally and sections of the line were removed, threads recut, new fittings supplied, and short pieces inserted to make up the length. This continued until October 1910, when it was found that the pipe was getting too thin to be rethreaded successfully and the line was removed and scrapped. At this time there was a hard yellow deposit in the pipe, uniformly ½ inch thick, which had cut down the available flow to less than 10 gallons per minute. During 1906 and 1907, 4 per cent solutions had been used much of the time, with periods when the strength had been increased to 6 per cent. During 1908, 1909 and 1910, 6 per cent solutions were the rule with occasional resort to 8 per cent strength. This 2-inch pipe weighed 48 pounds per length of 12 feet when installed in 1906 and 31 pounds per length when discarded in 1910.

Experience with this line made it evident that higher rate of flow was necessary to prevent plugging. Consequently a line of 1½-inch standard brass pipe with heavy pattern fittings was put in in October 1910. The experience with this line was much like that with its predecessor, except that there was little trouble with plugging. Occasionally leaks started at the joints, necessitating the removal of certain lengths, rethreading, inserting new fittings, etc., and

[1] Read at meeting of New York Section, December 15, 1915.

with attention of this nature the line lasted until May, 1914. When the pipe was scrapped it was found to be clean and bright inside, free from any deposit, and worn somewhat thinner on one side than on the other. This pipe weighed 36 pounds per length of 12 feet when installed in October, 1910, and 26 pounds per length when scrapped in May, 1914. During 1911 and 1912, 8 per cent solutions had been used most of the time, whereas from that date on to May 1914, 12 and 16 per cent solutions were in service. This line carried an average flow of 7½ gallons per minute as had been the case with the earlier 2-inch line, so that the linear velocity in the 1½-inch line was 71 feet per minute.

In May, 1914, the first 1½-inch line was supplanted by a new one of brass, similar in essential detail. This line gave no trouble from leaks until April, 1915, when it suddenly showed signs of going to pieces generally, and examination disclosed the fact that the pipe had lost 6 pounds per length in less than a year. This line had been conveying 16 and 20 per cent solutions ranging in temperature from 70 to 80° F. during the winter months. This increased temperature was occasioned by preheating the water to facilitate preparation of solutions. The rate of flow was materially the same as in previous years.

It became evident that brass was not going to handle these solutions of increased strength, and consequently, in April 1915, a new 1½-inch line of commercial copper tube with special copper fittings of heavy pattern was installed. Experience with the previous line made it clear that the trouble with ordinary brass pipe was not so much in its tendency to corrosion in general as in its specific inability to stand up at the joints. Consideration of a typical threaded joint in which much of the metal is cut away to form the threads, shows that the whole line is no more permanent than this weakest point. It is helping matters but little to increase the thickness of the pipe and fittings. To overcome this difficulty what is known as the slipjoint fitting was adopted and still another line of 1½-inch pipe installed, in this case of commercial bronze, made up with these special fittings. These were made according to the writer's specifications. This line was put in in May 1915, and the bronze pipe showed a loss of 2½ pounds per length of 12 feet on November 13, after six months' service. The copper pipe showed a loss of only ½ pound per length of 12 feet in seven months of service. With these slipjoint fittings a line of pipe can be made up with extreme ease and rapidity; a section may be removed anywhere without disturbing the rest of the line, and the labor involved is slight. These factors are of great value in a filter plant where interruptions to the service are serious. Moreover, it should be possible to use with these fittings pipe which has become much too thin to admit of the ordinary threading process, and thereby effect a material saving.

Pipe made up with these fittings must be properly supported and if it is to carry any considerable pressure care must be used to anchor the line properly. These and other details, however, are matters peculiar to each installation and do not detract from the fundamental purpose for which the fittings have been adopted, namely to dispense with the threaded joint.

Summarizing the experiences with brass pipe and fittings:

First. Ordinary brass pipe and heavy pattern fittings may be expected to give several years' service conveying alum solutions of 8 per cent strength or less.

Second. Threaded pipe will give more or less trouble from leaks at the joints and will have to be taken down and rethreaded at least once during the possible life of the pipe. Slipjoint fittings present distinct advantages over ordinary threaded ones because of the above consideration.

Third. For conveying alum solutions of more than 8 per cent strength brass is not suitable.

Fourth. Increasing the temperature of alum solution greatly increases its solvent action on brass.

Fifth. The presence of iron in certain forms in filter alum seems to increase its corrosive action upon brass to a marked degree. In support of this statement the writer will relate the details of a rather disastrous experience:

In April 1914, a carload of special iron and aluminum sulphate was received to try out on a practical scale. It was stated to contain about 2 per cent of iron in the ferric form in addition to the ordinary 17 per cent of alumina, and should, therefore, be much more potent as a coagulant. It was made up in 16 per cent strength as customary and the test started. After thirty-two hours a 1½-inch gate valve on the application tank started to leak badly. It was replaced with a new one and as the valve had been in service some time no particular attention was paid to the incident. Twenty hours later alum solution started to squirt through the bonnet of the new valve and the test was summarily finished. After taking account of the damage done it was found necessary to practically rebuild the alum piping system, and the next month, May 1914, the new line of 1½ inch brass already spoken of was put in. The 1½ inch gate valve that was completely ruined in twenty hours would have lasted from two to four months with ordinary filter alum.